

### In Brief

People with diabetes are at much higher risk for cardiovascular disease (CVD) than the average population. Evidence-based, prioritized, and strategic management of CVD risk factors among people with diabetes is necessary for the improvement of its burden on disability, morbidity, mortality, and high health care costs. Risk factors for diabetes and CVD are similar, and most can be effectively decreased by lifestyle modification. Medical nutrition therapy and other lifestyle recommendations for CVD prevention and treatment are discussed.

## Prevention and Treatment of Cardiovascular Disease in People With Diabetes Through Lifestyle Modification: Current Evidence-Based Recommendations

Raquel Franzini Pereira, MS, RD, LD, and Marion J. Franz, MS, RD, LD, CDE

Lifestyle modification is effective in the improvement of many cardiovascular risk factors,<sup>1,2</sup> and among those at high risk for cardiovascular disease (CVD), the benefits of lifestyle modification are proportionally higher.<sup>3</sup> Risk assessment for primary prevention of CVD and stroke should include regularly updated family history, smoking status, food and nutrition patterns, alcohol intake, physical activity, blood pressure, body mass index (BMI), waist circumference, pulse, fasting serum lipoprotein profile (or total and

HDL cholesterol if fasting is unavailable), and fasting blood glucose.<sup>4</sup> People with diabetes are at a three- to fourfold increased risk for CVD, and this increase is particularly evident in younger age groups and women. Diabetes has been designated as a “CVD risk equivalent—that is, persons with diabetes have the equivalent CVD risk as persons with preexisting CVD and no diabetes.”<sup>1</sup> Both diabetes and CVD are challenging to the interdisciplinary health care team.

Evidence-based, prioritized, and strategic management of CVD risk factors among people with diabetes is necessary for the improvement of its burden on disability, morbidity, mortality, and high health care costs. Overall, CVD accounts for > 35% of all deaths in the United States, which in 2004 was at a rate of 2,400 people dying each day in the general population, 17% of them being < 65 years of age.<sup>5</sup> Pathogenic processes and risk factors for diabetes and CVD are similar, and most patients with type 2 diabetes die prematurely from a cardiovascular event.<sup>6</sup> CVD is also among the most preventable health problems in the nation.<sup>5</sup> Therefore, the strategic use of evidence-based practice guidelines can improve practitioners' efforts towards prevention and treatment of CVD among people with diabetes.

Hypertension affects nearly one in three adults in the United States,<sup>7,8</sup> and it has been argued that hypertension management is most crucial for people with diabetes based on epidemiological analyses and randomized clinical trials.<sup>1</sup> Hypertension is defined as systolic blood pressure  $\geq$  140 mmHg or diastolic blood pressure  $\geq$  90 mmHg or current use of an antihypertensive medicine.<sup>9</sup> Lifestyle factors that may lower blood pressure are sodium restriction; weight reduction or physical activity programs; and reduction of excessive alcohol intake.<sup>3</sup> Every routine diabetes visit should include a blood pressure measurement, and if values are 130–139 mmHg for systolic blood pressure or 80–89 mmHg for diastolic blood pressure, lifestyle modification should be promoted, without drug therapy. Drug therapy along with lifestyle modifications should be started at  $\geq$  140 mmHg for systolic blood pressure or  $\geq$  90 mmHg for diastolic blood pressure.<sup>1</sup>

To assist practitioners, the American Dietetic Association has developed the Evidence Analysis Library (EAL).<sup>10</sup> These evidence-based nutrition practice guidelines for various topics, diseases, and conditions address important nutrition practice questions and can be found at the American Dietetic Association's EAL Web site ([www.adaevidencelibrary.org](http://www.adaevidencelibrary.org)). Access to the executive summary of recommendations in the EAL Web site is open to the general public, but more details are available to registered dietitians (RDs) and other professionals who are members of the American

Dietetic Association or the American Association of Diabetes Educators and to other EAL subscribers. The recommendations in the EAL Web site are graded as strong, fair, weak, consensus, and insufficient evidence. An in-depth explanation of these ratings is available on the EAL Web site.<sup>10</sup>

### Cardioprotective Medical Nutrition Therapy

Lifestyle changes improve the lipid profile of people with diabetes and should be a priority among these individuals.<sup>1</sup> Lipid profiles improve when there is a reduction of saturated fat and cholesterol intake, weight loss when appropriate, and an increase in dietary fiber and physical activity.<sup>1,11</sup> In terms of medical nutrition therapy (MNT) to prevent CVD for people with diabetes, it is important to note the following: an optimal combination of macronutrients to prevent CVD has not been determined and may not even exist; it varies according to individual circumstances.<sup>2,12</sup>

The American Diabetes Association (ADA) and the American Dietetic Association have published nutrition therapy recommendations and interventions that are very similar but use different processes.<sup>2,12</sup> A comparison of these recommendations is available at [www.dce.org/links/jada/00448.htm](http://www.dce.org/links/jada/00448.htm). The American Dietetic Association's evidence-based nutrition practice guidelines (EBNPG) use a format adopted from *Guidelines Elements Model* and criteria established by the National Guidelines Clearinghouse, which is a database of evidence-based clinical practice guidelines created by the Agency for Healthcare Research and Quality.<sup>13,14</sup> Quality criteria from the Appraisal of Guidelines Research and Evaluation Instrument are used as the basis for development and as the evaluation tool before publication.<sup>15</sup>

To answer the question, "What is the evidence supporting specific nutrition interventions in studies of a minimum 1-year duration for the prevention of CVD in people with diabetes?" the American Dietetic Association EBNPG reviewed a total of 12 studies and concluded that nutrition interventions such as a Mediterranean dietary pattern and multifactorial nutrition interventions reduce the risk for the development of CVD.<sup>2</sup> To answer the question, "What is the evidence supporting specific nutrition interventions in the treatment

of CVD in people with diabetes?" 21 studies were reviewed. Table 1 lists the American Dietetic Association EBNPG recommendations for the prevention and treatment of CVD in people with diabetes.<sup>2,11,16</sup>

### Physical Activity

A physically active lifestyle is known to have a key role in health promotion and chronic disease prevention.<sup>17</sup> Physical activity is vital to diabetes management,<sup>18,19</sup> not only because of its beneficial effects on weight management and blood glucose management, but also because of its role in reducing cardiovascular risk factors and all-cause mortality.<sup>20</sup> MNT and aerobic exercise have been shown to reduce blood pressure and improve lipids and are integral components of glucose and weight management.<sup>21,22</sup> MNT and aerobic exercise are also predictors of age-specific mortality and cardiovascular event rates.<sup>1</sup> Beneficial effects on cardiovascular risk from physical activity are likely to be related to improvements in insulin sensitivity and are independent of weight loss.<sup>19</sup>

People with diabetes, to reduce their risk of CVD, need at least 150 minutes of moderate-intensity aerobic physical activity per week or at least 90 minutes of vigorous aerobic exercise per week (30–60 minutes on most, or preferably all, days of week), in addition to an increase in daily lifestyle activities, which can include gardening, household work, or even walking breaks during the workday.<sup>1</sup>

### Stress

Although increasing evidence links the risk of cardiovascular disease with environmental and psychosocial factors, research is still not conclusive about how it contributes to heart disease risk,<sup>23</sup> or how stress management and other forms of psychological intervention for people with heart disease reduce risk for another CVD incident or even help with anxiety or depression.<sup>24</sup>

### Tobacco

An estimated 34.7% of all deaths resulting from cigarette smoking are related to CVD.<sup>25</sup> Because cigarette smoking significantly increases the risk for developing atherosclerosis, hypertension, and stroke, and it is the most important preventable cause of premature death in the United States, proper interventions for smoking cessation

are necessary.<sup>23</sup> Although prevalence of smoking has decreased, people with diabetes are likely to smoke at the same rate as people without diabetes, and physicians do not always provide advice on quitting, as reported by smokers with diabetes.<sup>26</sup>

There is evidence that psychological smoking cessation interventions are effective in the promotion of abstinence at 1 year.<sup>27</sup> Comprehensive

tobacco control programs, which include mass media campaigns, can be effective in changing smoking behavior, but their most effective length and intensity has yet to be studied.<sup>28</sup>

**Conclusion**

Lifestyle modification is effective in the improvement of many cardiovascular risk factors. According to the American Dietetic Association

EBNPG, the strongest recommendations to prevent CVD in people with diabetes are the following:

- Cardioprotective nutrition interventions should be implemented in the initial series of encounters and should include reduction in saturated and *trans* fats and dietary cholesterol and interventions to improve blood pressure; nutrition plans should be individualized to

**Table 1. American Dietetic Association Type 1 and Type 2 Diabetes Evidence-Based Nutrition Practice Guidelines for the Prevention and Treatment of CVD, *continued on p. 192***

	Recommendations and Ratings
CVD and Cardioprotective Nutrition Therapy	<ul style="list-style-type: none"> <li>• Cardioprotective nutrition interventions for the prevention and treatment of CVD should be implemented in the initial series of encounters. <b>Strong *</b></li> <li>• Cardioprotective nutrition interventions include reduction in saturated and <i>trans</i> fats and dietary cholesterol and interventions to improve blood pressure. <b>Strong</b></li> </ul>
Cardioprotective Nutrition Therapy Interventions	<ul style="list-style-type: none"> <li>• The cardioprotective dietary pattern should be individualized to provide a fat intake of 25–35% of total calories, &lt; 7% total calories from saturated fat and <i>trans</i> fatty acids, and &lt; 200 mg cholesterol per day. This pattern can lower LDL cholesterol up to 16% and decrease risk of CVD. <b>Strong</b></li> <li>• Saturated fat and <i>trans</i> fatty acids should be as low as possible and at a maximum of 7% of total calories. Individuals at a healthy weight and normal lipid profile should replace the saturated fatty acids calories with unsaturated fat and/or complex carbohydrates and protein. <b>Strong</b></li> <li>• Foods containing 25–30 grams of fiber per day should be included, with special emphasis on soluble fiber sources (7–13 grams). <b>Strong</b></li> <li>• Omega-3 fatty acids, preferably from marine and plant sources, should be included in a cardioprotective diet if it is according to patients’ preference or places no harm or risk. Supplements with 1 gram of EPA and DHA omega-3 can be used for individuals who do not eat these food sources. <b>Fair †</b></li> <li>• Plant sterol and stanol ester–enriched foods consumed two or three times per day, for a total of 2–3 grams per day, may be used in addition to the cardioprotective diet to further lower total cholesterol by 4–11% and LDL by 7–15%. Consider according to patients’ preferences and whether it places no harm or risk. <b>Strong</b></li> <li>• Soy protein (26–50 grams per day) in place of animal protein can reduce total cholesterol by 0–20% and LDL by 4–24%. Consider according to patients’ preferences and whether it places no harm or risk. <b>Fair</b></li> <li>• Five ounces of nuts per week may be isocalorically included into the diet. Consider according to patients’ preferences and whether it places no harm or risk. <b>Fair</b></li> <li>• There is no evidence to suggest alcohol consumption if a patient does not drink or to suggest that a certain type of alcohol is better than another. A maximum of one drink per day for women and up to two drinks per day for men may be incorporated into the diet for those who already drink and have no contraindications. This level of alcohol intake is associated with reduced risk of CVD. <b>Fair</b></li> <li>• Risk reduction has not been observed with antioxidant supplements (vitamin E, vitamin C, and beta-carotene). <b>Strong</b></li> <li>• Antioxidant-rich fruits, vegetables, and whole grains are associated with reduced disease risk. <b>Fair</b></li> <li>• The following vitamin supplements should not be taken with a simvastatin/niacin drug combination: vitamin E, vitamin C, beta-carotene, and selenium. Beta-carotene supplementation cannot be recommended in individuals with a smoking habit. <b>Fair</b></li> <li>• Folate, vitamin B<sub>6</sub>, and vitamin B<sub>12</sub> to meet the DRI should be planned into the food pattern. In the cases of high serum homocysteine levels (usually &gt; 13 μmol/l), a reduction by 17–35% can be observed. <b>Fair</b></li> <li>• Supplemental folate (alone or in combination with vitamin B<sub>6</sub> and vitamin B<sub>12</sub>) may or may not be beneficial. Consult with patients’ physician. <b>Weak ‡</b></li> <li>• Research is inconclusive regarding the relationship between coenzyme Q10 and risk for disease. <b>Insufficient Evidence §</b></li> </ul>

- provide a fat intake of 25–35% of total calories, saturated fat and *trans* fatty acids should be as low as possible and at a maximum of 7% of total calories, and < 200 mg cholesterol per day.
- Foods containing 25–30 grams of fiber per day should be included,
- with special emphasis on soluble fiber sources (7–13 grams).
- Plant sterol and stanol ester–enriched foods consumed two or three times per day for a total of 2–3 grams per day may be used
- in addition to the cardioprotective diet.
- Antioxidant supplements (vitamin E, vitamin C, and beta-carotene) have not been observed to reduce risk.
- Sodium intake should be limited to ≤ 2,300 mg per day; the Dietary

**Table 1. American Dietetic Association Type 1 and Type 2 Diabetes Evidence-Based Nutrition Practice Guidelines for the Prevention and Treatment of CVD, *continued from p. 191***

Hypertension Nutrition Therapy Interventions	<ul style="list-style-type: none"> <li>The DASH dietary plan should be adopted and reduces blood pressure by 8–14 mmHg. It is rich in fruits, vegetables, low-fat dairy, and nuts; low in sodium, total fat, and saturated fat; and adequate in calories for weight management. <b>Consensus</b>   </li> <li>Limit sodium intake to ≤ 2,300 mg sodium per day because it lowers systolic blood pressure by ~ 2–8 mmHg. <b>Strong</b></li> <li>The DASH dietary pattern or reduction in sodium to 1,600 mg per day should be recommended after a patient adheres to a 2,300-mg sodium diet and does not achieve the treatment goals for reduction in blood pressure. <b>Strong</b></li> <li>Recommend eating at least five to 10 servings of fruits and vegetables per day. <b>Strong</b></li> <li>Recommend eating adequate food sources of potassium as part of nutrition therapy because low consumption is associated with increased blood pressure. <b>Fair</b></li> <li>The effect of magnesium as a single nutrient on blood pressure is unknown. <b>Fair</b></li> <li>The effect of calcium as a single nutrient on blood pressure is unclear, but dietary patterns with calcium lower than recommended levels (i.e., lower than DRI) may be associated with elevated blood pressure. <b>Fair</b></li> <li>Monitoring of blood pressure is advised for those who consume caffeine. Acute intake increases blood pressure, but the effect of chronic intake is unclear. <b>Weak</b></li> <li>The effects of the following on blood pressure are unclear: increased protein intake, soluble fiber, vitamin C, vitamin E, soy intake, garlic, cocoa, and chocolate. <b>Weak</b></li> <li>Consumption of omega-3 fatty acids does not seem to benefit hypertension management. <b>Fair</b></li> <li>Consumption of alcohol should be limited to no more than two drinks per day in most men and no more than one drink per day in women. Reduction in alcohol consumption may reduce systolic blood pressure by ~2–4 mmHg. <b>Consensus</b> ‡</li> <li>Weight reduction lowers systolic blood pressure by 5–20 mmHg per 22 lb (10 kg) of body weight loss; therefore, optimal body weight should be achieved. <b>Consensus</b></li> </ul>
Physical Activity	<ul style="list-style-type: none"> <li>In people with type 2 diabetes, 90–150 minutes of accumulated moderate-intensity aerobic physical activity per week, as well as resistance training/strength training three times per week, is recommended. Both aerobic and resistance training improve glycemic control independent of weight loss. Physical activity also improves insulin sensitivity and decreases the risk for CVD and all-cause mortality. <b>Strong</b></li> <li>Individuals with type 1 diabetes should be encouraged to engage in regular physical activity. Although exercise is not reported to improve glycemic control in people with type 1 diabetes, individuals may receive the same benefits from exercise as the general public: decreased risk of CVD and improved sense of well-being. <b>Fair</b></li> </ul>

\* Practitioners should follow strong recommendations unless a clear and compelling rationale for an alternative approach is present.

† Practitioners should generally follow fair recommendations but remain alert to new information and be sensitive to patient preferences.

‡ Practitioners should be cautious in deciding whether to follow weak recommendations. Patient preference should have a substantial influencing role.

§ Practitioners should feel little constraint in deciding whether to follow insufficient evidence recommendations. Patient preference should have a substantial influencing role.

//Practitioners should feel little constraint in deciding whether to follow recommendations based on consensus. Patient preference should have a substantial influencing role.

Source: Recommendations and ratings are from the American Dietetic Association Evidence Based Library. Available at: <http://www.adaevidencelibrary.com/topic.cfm?cat=2690>; <http://www.adaevidencelibrary.com/topic.cfm?cat=3252>; <http://www.adaevidencelibrary.com/topic.cfm?cat=3015>; <http://www.adaevidencelibrary.com/topic.cfm?cat=3259>.



Approaches to Stop Hypertension (DASH) dietary pattern or reduction in sodium to 1,600 mg per day should be recommended after patients adhere to a 2,300-mg sodium limit and do not achieve their treatment goals for reduction in blood pressure.

- Intake of at least five to 10 servings of fruits and vegetables per day is recommended.
- Ninety to 150 minutes of accumulated moderate-intensity aerobic physical activity per week, as well as resistance training/strength training three times per week, is encouraged.

## References

- <sup>1</sup>Buse JB, Ginsberg HN, Bakris GL, Clark NG, Costa F, Eckel R, Fonseca V, Gerstein HC, Grundy S, Nesto RW, Pignone MP, Plutzky J, Porte D, Redberg R, Stitzel KF, Stone NJ: Primary prevention of cardiovascular diseases in people with diabetes mellitus: a scientific statement from the American Heart Association and the American Diabetes Association. *Circulation* 115:114–126, 2007
- <sup>2</sup>American Dietetic Association: Type 1 and type 2 diabetes evidence-based nutrition practice guidelines for adults [article online]. Available from <http://www.adaevidencelibrary.com/topic.cfm?3252>. Accessed April 6, 2008
- <sup>3</sup>Watkins PJ: ABC of diabetes: cardiovascular disease, hypertension and lipids. *BMJ* 326:874–876, 2003
- <sup>4</sup>Pearson TA, Blair SN, Daniels SR, Eckel RH, Fair JM, Fortmann SP, Franklin BA, Goldstein LB, Greenland P, Grundy SM, Hong Y, Miller NH, Lauer RM, Ockene IS, Sacco RL, Sallis Jr JF, Smith Jr SC, Stone NJ, Taubert KA: AHA guidelines for primary prevention of cardiovascular disease and stroke: 2002 update: consensus panel guide to comprehensive risk reduction for adult patients without coronary or other atherosclerotic vascular diseases. *Circulation* 106:388–391, 2002
- <sup>5</sup>Centers for Disease Control and Prevention: Heart disease and stroke: the nation's leading killers [article online]. Available from <http://www.cdc.gov/nccdphp/publications/aag/dhdsp.htm>. Accessed April 5, 2008
- <sup>6</sup>Zimet P: The burden of type 2 diabetes: are we doing enough? *Diabetes Metab* 29(4 Pt 2):6S96S18, 2003
- <sup>7</sup>Fields LE, Burt VL, Culter JA, Hughes J, Roccella EJ, Sorlie P: The burden of adult hypertension in the United States 1999–2000: a rising tide. *Hypertension* 44:398–404, 2004
- <sup>8</sup>Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense H, Joffres M, Kastarinen M, Poulter N, Primatesta P, Rodríguez-Artalejo F, Stegmayr B, Thamm M, Tuomilehto J, Vanuzzo D, Vescio F: Hypertension prevalence and blood pressure levels in 6 European countries, Canada and the United States. *JAMA* 289:2363–2369, 2003
- <sup>9</sup>Rosmond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, Haase N, Ho M, Howard V, Kissela B, Kittner S, Lloyd-Jones D, McDermott M, Meigs J, Moy C, Nichol G, O'Donnell CJ, Roger V, Rumsfeld J, Sorlie P, Steinberger J, Thom T, Wasserthiel-Smolter S, Hong Y and for the American Heart Association Statistics Committee and Stroke Statistics Subcommittee: Heart disease and stroke statistics—2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 115:e69–e171, 2007
- <sup>10</sup>American Dietetic Association: Evidence Analysis Library: Available online from <http://www.adaevidencelibrary.com>. Accessed March 28, 2008
- <sup>11</sup>American Dietetic Association: Disorders of lipid metabolism evidence-based nutrition practice guidelines for adults [article online]. Available from <http://www.adaevidencelibrary.com/topic.cfm?3015>. Accessed 6 April 2008
- <sup>12</sup>American Diabetes Association: Nutrition recommendations and interventions for diabetes. *Diabetes Care* 31 (Suppl. 1):S61–S78, 2008
- <sup>13</sup>Yale University: Guideline Elements Model [article online]. Available from <http://gem.med.yale.edu/default.htm>. Accessed June 6, 2007
- <sup>14</sup>Agency for Healthcare Research, United States Department of Health and Human Services: Quality National Guidelines Clearinghouse. Available from <http://www.guideline.gov>. Accessed June 6, 2007
- <sup>15</sup>AGREE Collaboration: appraisal of guideline research and evaluation [article online]. Available from <http://www.agreecollaboration.org/intro>. Accessed June 6, 2007
- <sup>16</sup>American Dietetic Association: Hypertension evidence-based nutrition practice guidelines for adults [article online]. Available from <http://www.adaevidencelibrary.com/topic.cfm?3259>. Accessed 6 April 2008
- <sup>17</sup>Haskell WL, Lee I, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A: Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Circulation* 116:1081–1093, 2007
- <sup>18</sup>Hayes C, Kirska A: Role of physical activity in diabetes management and prevention. *J Am Diet Assoc* 108:S19–S23, 2008
- <sup>19</sup>American Diabetes Association: Physical activity/exercise and diabetes [Position Statement]. *Diabetes Care* 27 (Suppl. 1):S58–S62, 2004
- <sup>20</sup>Bianchi C, Penno G, Miccoli R, Del Prato S: Primary prevention of cardiovascular disease in people with dysglycemia. *Diabetes Care* 31 (Suppl. 2):S208–S214, 2008
- <sup>21</sup>Franz MJ, Bantle JP, Beebe CA, Brunzell JD, Chiasson JL, Garg A, Holzmeister LA, Hoogwerf B, Mayer-Davis E, Mooradian AD, Purnell JQ, Wheeler M; American Diabetes Association: Nutrition principles and recommendations in diabetes. *Diabetes Care* 27 (Suppl. 1):S36–S46, 2004
- <sup>22</sup>Sigal RJ, Kenny GP, Wasserman DH, Castaneda-Sceppa C: Physical activity/exercise and type 2 diabetes. *Diabetes Care* 27:2518–2539, 2004
- <sup>23</sup>American Heart Association: Stress and heart disease [article online]. Available from <http://www.americanheart.org/presenter.jhtml?identifier=4750>. Accessed 5 April, 2008
- <sup>24</sup>Rees K, Bennett P, West R, Davey Smith G, Ebrahim S: Psychological interventions for coronary heart disease. *Cochrane Database Syst Revs* Issue 2, 2004
- <sup>25</sup>Centers for Disease Control and Prevention: Annual smoking-attributable mortality, years of potential life lost, and productivity losses: United States, 1997–2001. *MMWR Morb Mortal Wkly Rep* 54:625–628, 2005
- <sup>26</sup>Malarcher AM, Ford ES, Nelson DE, Chrismon JH, Mowery P, Merritt RK, Herman WH: Trends in cigarette smoking and physicians' advice to quit smoking among people with diabetes in the U.S. *Diabetes Care* 18:694–697, 1995
- <sup>27</sup>Barth J, Critchley J, Bengel J: Psychosocial interventions for smoking cessation in patients with coronary heart disease. *Cochrane Database Syst Revs* Issue 1, 2008
- <sup>28</sup>Bala M, Strzeszynski L, Cahill K: Mass media interventions for smoking cessation in adults. *Cochrane Database Syst Revs* Issue 1, 2008

Raquel Franzini Pereira, MS, RD, LD, is the Health and Wellness Manager at the Minneapolis Heart Institute Foundation in Minneapolis, Minn. Marion J. Franz, MS, RD, LD, CDE, is a nutrition/health consultant, Nutrition Concepts by Franz, Inc., in Minneapolis, Minn.